SELF-REFERENCING/BODY MOTION TRACKING NON-INVASIVE INTERNAL TEMPERATURE DISTRIBUTION MEASUREMENT METHOD AND APPARATUS USING MAGNETIC RESONANCE TOMOGRAPHIC IMAGING TECHNIQUE

ABSTRACT

A noninvasive image measuring method of measuring internal organ/tissue temperature using an MRI system. Temperature measurement insusceptible to body motion and spatial variation of magnetic field is realized by utilizing the position and size of a temperature change region as *a priori* information to determine the phase distribution of the complex magnetic resonance signal of water proton at a given temperature point and by subtracting the phase distribution before the temperature change estimated (self-referred) from the phase distribution in the peripheral region for each pixel of the image, thereby eliminating the subtraction process of image before and after temperature change. The precision of temperature measurement can be enhanced by estimating a complex curved surface formed of the peripheral region in each temperature change region of the real-part and imaginary-part images of the complex magnetic resonance signal, and calculating the phase difference between an actually measured complex signal distribution and the estimated complex signal distribution of the complex signal distribution for each pixel, thereby reducing the estimation error due to phase transition from $-\pi$ to $+\pi$ occurring in a phase distribution. Furthermore, temperature can be measured through optimal imaging following up body motion by using an optical positioning system in combination even if the part being measured is shifted.